APPENDIX F

Emission Calculation Fact Sheet

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MINERAL PRODUCT PROCESSES

The purpose of this document is to provide guidance for calculating emissions from mineral product processes at lime manufacturing, limestone, gypsum, stone quarrying, concrete recycling, asphalt pavement recycling, and sand and gravel facilities. These processes include, but are not limited to, Standard Industrial Classifications (SIC) 1422, 1423, 1429, 1442, 1446, and 1499. This document lists Source Classification Codes (SCC) and emission factors for mineral product processes. The emission factors were obtained from the Factor Information Retrieval (FIRE) Data System, Versions 6.23 & 6.24 or the Environmental Protection Agency's (EPA) *Compilation of Air Pollutant Emission Factors (AP-42).* Both are available on the Internet at **www.epa.gov/ttn/chief/index.html**.

It is not required that facilities use these listed factors to quantify their emissions. If a facility disagrees with any emission factor in this document, it may use other emission factors or another method of calculating emissions providing the emission factor or method correctly characterizes the processes and the resulting emissions at the facility. A facility doing so must submit calculations and documentation showing the source of the factors or method used and justification for their use.

In addition to the specific individual component emission factors, this document also contains a combination plant-wide general emission factor for use by sand and gravel, concrete recycling, limestone, asphalt pavement recycling, gypsum, and stone quarrying operations with an annual production of 2,000,000 tons or less. The combination general factor was developed by the Air Quality Division to aid these smaller sources in making calculations. A facility is not required to use the plant-wide general emission factor – it may use the more specific emission factors for each individual process or it may calculate emissions by some other method.

Portable Sources
Portable sources must submit a Supplemental Portable Form (SP-101) when reporting their emissions. For information about the SP-101 form and other portable source requirements, refer to the *MAERS General Instructions*.

Control Factors
If a facility has control equipment, the emissions can be multiplied by a control factor. Calculate the control factor by subtracting the percent control efficiency from 100 and then divide that number by 100. For example, if the control efficiency is 87%, the control factor would be (100 - 87)/100 = 0.13. Control efficiencies may be listed on the equipment or in the equipment documentation. Alternatively, equipment suppliers can provide control efficiency values. Facilities with a DEQ, Air Quality Division approved Fugitive Dust Plan are allowed to use an 80% control efficiency for fugitive dust emissions. However, the use of this value is not mandated and derived control factors may be used if information and documentation showing the source of the control factor and justification for its use are submitted.

Scientific Notation
The emission factors are expressed in scientific notation, which means that the decimal point has been moved. If the exponent is negative, move the decimal point to the left. If the exponent is positive, move the decimal point to the right. If the exponent is zero, the decimal point does not move. For example, if a number is expressed as 2.0E-1, move the decimal point one place to the left to get 0.20. If a number is expressed as 2.0E2, move the decimal point 2 places to the right to get 200. If a number is expressed as 2.0E0, the decimal point does not move – the number is 2.0. A number expressed as E3 is 1,000.

TOTAL PLANT-WIDE emission factors are permissible, instead of reporting emissions for individual processes, provided less than 2,000,000 tons of product is produced annually at the site. Facilities may use 80% as the control efficiency for a combined wet suppression and comprehensive fugitive dust control program. Emissions from generators and compressors must also be calculated (see Fuel Combustion Sources).

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS
3-05-025-01	Plant-wide particulate processes – uncontrolled	PM10,FLTRBLE PM,FLTRBLE*	5.0E-2 LB/TON SAND & GRAVL 1.0E-1 LB/TON SAND & GRAVL

*You do not have to report PM,FLTRBLE emission in MAERS. This factor is provided for other emission calculation purposes (e.g., demonstrating compliance with R 336.1290(a)(iii)).

APPENDIX F: MINERAL PRODUCT PROCESSES EMISSION CALCULATION FACT SHEET

SAND AND GRAVEL OPERATIONS include wash plants, crushers, screens, etc. Sand and gravel is defined as unconsolidated granular materials resulting from the natural disintegration of rock or stone. They are products of the weathering of rocks and unconsolidated or poorly consolidated materials. Facilities may use the uncontrolled emission factors with 80% control efficiency if using a wet suppression system and a comprehensive fugitive dust control program or an alternate control factor with justification.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS
3-05-025-02	Aggregate storage - uncontrolled	PM10,FLTRBLE	1.2E-1 LB/TON PRODUCT
3-05-025-03	Material transfer points and conveying – uncontrolled	PM10,FLTRBLE PM,FLTRBLE*	6.4E-3 LB/TON SAND & GRAVL 2.9E-2 LB/TON SAND & GRAVL
3-05-025-04	Hauling – uncontrolled	PM10,FLTRBLE	6.2E0 LB/MILE DEVICE
3-05-025-05	Pile forming – stacker – uncontrolled	PM10,FLTRBLE	6.0E-2 LB/TON SAND & GRAVL
3-05-025-06	Bulk (truck) loading – uncontrolled	PM10,FLTRBLE PM,FLTRBLE*	2.4E-3 LB/TON SAND & GRAVL 2.0E-2 LB/TON SAND & GRAVL
3-05-025-10	Primary crushing – uncontrolled	PM10,FLTRBLE	2.4E-3 LB/TON SAND & GRAVL
3-05-025-10	Secondary crushing – uncontrolled	PM10,FLTRBLE	2.4E-3 LB/TON SAND & GRAVL
3-05-025-10	Tertiary crushing – uncontrolled	PM10,FLTRBLE	2.4E-3 LB/TON SAND & GRAVL
3-05-025-11	Screening – uncontrolled	PM10,FLTRBLE	1.2E-1 LB/TON SAND & GRAVL

*You do not have to report PM,FLTRBLE emission in MAERS. This factor is provided for other emission calculation purposes (e.g., demonstrating compliance with R 336.1290(a)(iii)).

STONE QUARRYING OPERATIONS, LIME MANUFACTURING, LIMESTONE OPERATIONS, CONCRETE RECYCLING, AND ASPHALT PAVEMENT RECYCLING OPERATIONS are facilities primarily engaged in mining, quarrying, and crushing granite and associated rock (such as gneiss, gyenite and diorite). This category can also be used for limestone and lime processing because alternative emission factors are not readily available at this time. Facilities may use the uncontrolled emission factors with 80% control efficiency if using a wet suppression system and a comprehensive fugitive dust control program or other alternate control efficiency with justification.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS
3-05-020-01	Primary crushing – uncontrolled	PM10,PRIMARY	2.4E-3 LB/TON STONE
3-05-020-02	Secondary crushing – uncontrolled	PM10,PRIMARY	1.5E-2 LB/TON STONE
3-05-020-03	Tertiary crushing – uncontrolled	PM10,PRIMARY	1.5E-2 LB/TON STONE
3-05-020-04	Screening – uncontrolled	PM10,FLTRBLE	1.5E-2 LB/TON STONE
3-05-020-05	Fines crushing – uncontrolled	PM10,PRIMARY	1.5E-2 LB/TON STONE
3-05-020-06	Material transfer points and conveying – uncontrolled	PM10,PRIMARY	1.4E-3 LB/TON STONE
3-05-020-07	Open storage – uncontrolled	PM10,FLTRBLE	1.2E-1 LB/TON-YR PRODUCT

APPENDIX F: MINERAL PRODUCT PROCESSES EMISSION CALCULATION FACT SHEET

GYPSUM OPERATIONS are facilities primarily engaged in mining, quarrying, and crushing gypsum. Facilities may use the uncontrolled emission factors with 80% control efficiency if using a wet suppression system and a comprehensive fugitive dust control program or other alternate control efficiency with justification.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS
3-05-015-01	Rotary Ore Drier	PM10,FLTRBLE PM,FLTRBLE*	1.0E-2 LB/TON GYPSUM 4.0E-2 LB/TON GYPSUM
3-05-015-02	Primary Grinder/Roller Mills	PM10,FLTRBLE PM,FLTRBLE*	2.2E0 LB/TON GYPSUM 2.6E0 LB/TON GYPSUM
3-05-015-04	Conveying	PM10,FLTRBLE	1.5E-1 LB/TON GYPSUM
3-05-015-05	Primary Crushing	PM10,FLTRBLE	2.6E-1 LB/TON GYPSUM CRUDE
3-05-015-06	Secondary Crushing	PM10,FLTRBLE	1.13E0 LB/TON GYPSUM CRUDE
3-05-015-07	Screening	PM10,FLTRBLE	1.2E-1 LB/TON GYPSUM CRUDE
3-05-015-08	Open Storage – uncontrolled	PM10,FLTRBLE	1.2E-1 LB/TON GYPSUM CRUDE

*You do not have to report PM,FLTRBLE emission in MAERS. This factor is provided for other emission calculation purposes (e.g., demonstrating compliance with R 336.1290(a)(iii)).

STONE QUARRYING OPERATIONS, LIME MANUFACTURING, LIMESTONE OPERATIONS, GYPSUM OPERATIONS, CONCRETE RECYCLING, AND ASPHALT PAVEMENT RECYCLING OPERATIONS *(continued)*

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS
3-05-020-09	Blasting – uncontrolled	PM10,FLTRBLE	7.6E-2 LB/TON STONE**
3-05-020-10	Wet drilling- uncontrolled	PM10,PRIMARY	8.0E-5 LB/TON STONE
3-05-020-11	Hauling - uncontrolled	PM10,FLTRBLE	6.2E0 LB/MILE DEVICE
3-05-020-31	Truck unloading - uncontrolled	PM10,PRIMARY	1.6E-5 LB/TON STONE
3-05-020-32	Truck loading – Conveyor - uncontrolled	PM10,PRIMARY	1.0E-4 LB/TON STONE
3-05-020-33	Truck loading – Front end loader - uncontrolled	PM10,FLTRBLE	1.0E-4 LB/TON STONE

****** The following equation can be used instead of the emission factor: **PM10,FLTRBLE emissions = 1.4E-5 x $A^{1.5}$** where A is the horizontal area of the blast in square feet.

OVERBURDEN REMOVAL calculations should be performed in conjunction with the Limestone, Lime Manufacturing, Gypsum, and Stone Quarrying Operation calculations. Sand and gravel, concrete recycling, and asphalt pavement recycling operations are not required to perform the following calculations.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS
3-05-010-30	Topsoil removal - uncontrolled	PM10,FLTRBLE PM,FLTRBLE*	5.8E-2 LB/TON TOPSOIL 6.0E-2 LB/TON TOPSOIL
3-05-010-32	Topsoil unloading - uncontrolled	PM10,FLTRBLE PM,FLTRBLE*	4.0E-2 LB/TON TOPSOIL 4.0E-2 LB/TON TOPSOIL

APPENDIX F: MINERAL PRODUCT PROCESSES EMISSION CALCULATION FACT SHEET

OVERBURDEN REMOVAL *(continued)*

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS
3-05-010-37	Truck loading overburden - uncontrolled	PM10,FLTRBLE	1.5E-2 LB/TON OVERBURDEN
3-05-010-42	Truck loading – bottom dumping, overburden - uncontrolled	PM10,FLTRBLE PM,FLTRBLE*	1.0E-3 LB/TON OVERBURDEN 2.0E-3 LB/TON OVERBURDEN

*You do not have to report PM,FLTRBLE emission in MAERS. This factor is provided for other emission calculation purposes (e.g., demonstrating compliance with R 336.1290(a)(iii)).

FUEL COMBUSTION SOURCES include emissions from generators and compressors. Emissions from front-end loaders and trucks do not have to be calculated.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS
2-02-001-02	Distillate oil (Diesel)	CO NOX M10,FLTRBLE M2.5,FLTRBL OX TOC	1.30E2 LB/E3 GAL DIESEL FUEL 6.04E2 LB/E3 GAL DIESEL FUEL 4.25E1 LB/E3 GAL DIESEL FUEL 4.25E1 LB/E3 GAL DIESEL FUEL 3.97E1 LB/E3 GAL DIESEL FUEL 4.93E1 LB/E3 GAL DIESEL FUEL
2-02-002-02	Natural gas	CO NOX M10,PRIMARY M2.5,PRIMRY SOX VOC	3.99E2 LB/MMCF NATURAL GAS 2.84E3 LB/MMCF NATURAL GAS 2.011E1 LB/MMCF NATURAL GAS 2.011E1 LB/MMCF NATURAL GAS 6.0E-1 LB/MMCF NATURAL GAS 1.16E2 LB/MMCF NATURAL GAS
2-02-005-01	Residual/Crude oil	CO NOX PM10,FLTRBLE SOX TOC	1.3E2 LB/E3 GAL RESIDUAL OIL 6.04E2 LB/E3 GAL RESIDUAL OIL 4.25E1 LB/E3 GAL RESIDUAL OIL 1.55E2 LB/ KGAL-S% RESIDUAL OIL* 4.93E1 LB/E3 GAL RESIDUAL OIL
2-02-010-01	Liquefied petroleum gas (LPG) – Butane	CO NOX M10 VOC	3.57E1 LB/E3 GAL LPG 2.54E2 LB/E3 GAL LPG 8.95E-1 LB/E3 GAL LPG 1.04E1 LB/E3 GAL LPG
2-02-010-02	Liquefied petroleum gas (LPG) – Propane	CO NOX M10 VOC	3.57E1 LB/E3 GAL LPG 2.54E2 LB/E3 GAL LPG 8.95E-1 LB/E3 GAL LPG 1.04E1 LB/E3 GAL LPG

* KGAL-S% = (E3 GAL) X (S%) S% = WT% SULFUR IN OIL

SAMPLE CALCULATIONS

- For a facility using the plant-wide emission factor that processes 600,000 tons of product per year, the emissions would be as follow (the facility is not controlled):
  PM10: 600,000 ton product x 0.05 lb PM10/ton product x 0.0005 ton PM10/lb PM10 = 15 tons of PM10

- If the facility was controlled by a wet suppression system and a comprehensive fugitive dust control program, the controlled emissions (using 80% control) would be the following:
  PM10: 15 tons PM10 x (100 - 80) / 100 = 3 tons of PM10